

CLAIMS

1. An apparatus for analysing cardiac events detected in electrograms, EGMs, comprising a feature extraction means provided to derive features of said cardiac events for discriminating different kinds of detected cardiac events, and a clusterer provided to group cardiac events with similar features into a cluster, defined by predetermined cluster features, **characterized in** that said feature extraction means is adapted to determine a feature vector describing waveform characteristics of cardiac event EGM signals by a wavelet transform, and in that said clusterer is adapted to determine the distance between said feature vector and corresponding cluster feature vectors to assign the cardiac event in question to that cluster which results in a minimum distance, provided that said minimum distance is less than a predetermined threshold value.
2. The apparatus according to claim 1, each cluster being defined by a cluster center μ_i and a covariance matrix Σ_i for the respective cluster features, **characterized in** that said clusterer is adapted to determine a distance function d_i^2 between event feature vector and said cluster center μ_i .
3. The apparatus according to claim 2, **characterized in** that said clusterer is adapted to calculate said distance by using Mahalanobis distance criterion.
4. The apparatus according to claim 2 or 3, **characterized in** that said clusterer is adapted to determine the minimum of said distance by a grid search over the duration of the event.
5. The apparatus according to any of the preceding claims, **characterized in** that an integrating means is provided to integrate said distance over a predetermined period of time.
6. The apparatus according to any of the preceding claims, **characterized in** that said clusterer is adapted to update cluster features according to a predetermined rule on the basis of said minimum distance between cluster features and event features.

7. The apparatus according to any of the preceding claims, **characterized in** that said clusterer is adapted to create a new cluster, if said minimum distance between features of a detected cardiac event and features of existing clusters exceeds said predetermined threshold value, by setting features of a new cluster equal to the event features of the cardiac event in question.
8. The apparatus according to any of the preceding claims, **characterized in** that said clusterer is adapted to terminate clusters not, or only rarely, being provided with detected cardiac events within a predetermined time period.
9. The apparatus according to any of the preceding claims, **characterized in** that said clusterer is adapted to perform a likelihood based search sequence over the clusters to determine said minimum distance.
10. The apparatus according to any of the claims 4 - 8, **characterized in** that said clusterer is adapted to span said grid search only over the clusters.
11. The apparatus according to any of the preceding claims, **characterized in** that said clusterer is adapted to calculate the distance of a considered cardiac event from the previously selected cluster.
12. The apparatus according to any of the preceding claims, **characterized in** that a classifier is provided to associate the clusters with different specific cardiac rhythms according to predetermined rules.
13. A heart stimulator, **characterized by** an apparatus according to any of the preceding claims for on-line arrhythmia detection and control means for controlling the therapeutic stimulation depending on said arrhythmia detection.